Series 347

Granville-Phillips® Series 347 Stabil-Ion® Vacuum Gauge Module with DeviceNet™ Interface

BROOKS AUTOMATION

Instruction Manual

Instruction manual part number 347033
Revision 14 - June 2008

Series 347

Granville-Phillips® Series 347 Stabil-Ion® Vacuum Gauge Module with DeviceNet™ Interface

This Instruction Manual is for use with all Granville-Phillips Series 347 Stabil-Ion Vacuum Gauge Modules with DeviceNet Interface. A list of applicable catalog numbers is provided on the following page.

BROOKS AUTOMATION

Customer Service/Support

For customer service, 24 hours per day, 7 days per week, every day of the year including holidays, toll-free within the USA, phone 1–800–367–4887

For customer service within the USA, 8 AM to 5 PM, weekdays excluding holidays:

- Toll-free, phone: 1–800–776–6543
- Phone: 1–303–652–4400
- FAX: 1–303–652–2844
- Email: *co-csr@brooks.com*
- World Wide Web: www.brooks.com

Instruction Manual

Granville-Phillips® Series 347 Stabil-Ion®
Vacuum Gauge Module with DeviceNet™ Interface

Catalog numbers for Series 347 Stabil-Ion Modules (CE) with DeviceNet Interface

Power supply and cable are not included.

for Stabil-Ion Gauge with Yttria-coated filaments, extended range:

Module with no display	347031-X
Module with digial display	347032-X

for Stabil-Ion Gauge with tungsten filaments, extended range:

Module with no display	347046-X
Module with digial display	347047-X

for Stabil-Ion Gauge with Yttria-coated filaments, Ultra High Vacuum:

Module with no display	347048-X
Module with digial display	347049-X

for Stabil-Ion Gauge with tungsten filaments Ultra High Vacuum:

Module with no display	347050-X
Module with digial display	347051-X

Measurement Units:

Torr	T
mbar	M
pascal	P

Table of Contents

General Information

Receiving Inspection

On receipt of the equipment, inspect all material for damage. Confirm that the shipment includes all items ordered. If items are missing or damaged, submit a claim as stated below for a domestic or international shipment, whichever is applicable.

If materials are missing or damaged, the carrier that made the delivery must be notified within 15 days of delivery, or in accordance with Interstate Commerce regulations for the filing of a claim. Any damaged material including all containers and packaging should be held for carrier inspection. Contact Brooks Automation, Inc./Granville-Phillips Customer Support for assistance if your shipment is not correct for reasons other than shipping damage.

International Shipment

Inspect all materials received for shipping damage and confirm that the shipment includes all items ordered. If items are missing or damaged, the airfreight forwarder or airline making delivery to the customs broker must be notified within 15 days of delivery.The following illustrates to whom the claim is to be directed.

- If an airfreight forwarder handles the shipment and their agent delivers the shipment to customs, the claim must be filed with the airfreight forwarder.
- If an airfreight forwarder delivers the shipment to a specific airline and the airline delivers the shipment to customs, the claim must be filed with the airline.

Any damaged material including all containers and packaging should be held for carrier inspection. Contact Brooks Automation, Inc./Granville-Phillips Customer Support for assistance if your shipment is not correct for reasons other than shipping damage.

Warranty

Brooks Automation, Inc. provides an eighteen (18) month warranty from the date of shipment for new Brooks Automation, Inc./Granville-Phillips Products. The Brooks Automation, Inc. General Terms and Conditions of Sale provides the complete and exclusive warranty for Brooks Automation, Inc./Granville-Phillips products. This document is located on our web site at www.brooks.com, or may be obtained by contacting a Brooks Automation, Inc./Granville-Phillips Customer Service Representative.

Certification

Brooks Automation, Inc. certifies that this product met its published specifications at the time of shipment from the factory. Brooks Automation, Inc. further certifies that its calibration measurements are traceable to the National Institute of Standards and Technology to the extent allowed by the Institute's calibration facility.

Service Guidelines

Some minor problems are readily corrected on site. If the product requires service, please contact our Customer Service Department at 1-303-652-4400 for troubleshooting help over the phone. If the product must be returned for service, request a Return Authorization (RA) from Brooks Automation, Inc./Granville-Phillips. Do not return products without first obtaining an RA.

See the Service Form at the end of the Service and Maintenance chapter.

Shipping damage on returned products as a result of inadequate packaging is the Buyer's responsibility.

When returning equipment to Brooks Automation, Inc./Granville-Phillips, please use the original packing material whenever possible. Otherwise, contact your shipper or Brooks Automation, Inc./Granville-Phillips for safe packaging guidelines. Circuit boards and modules separated from the controller chassis must be handled using proper anti-static protection methods and must be packaged in anti-static packaging. Brooks Automation, Inc./Granville-Phillips will supply return packaging materials at no charge upon request.

FCC Verification

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

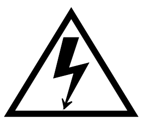
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or television technician for help.

Safety Information

General Cautions and Warnings

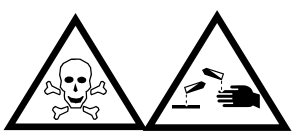
WARNING SYMBOLS

Read this instruction manual before installation, using, or servicing this equipment. If you have any doubts about how to use this equipment safely, call the Customer Support Center for assistance.



This symbol is associated with high voltage hazards. Follow all local and state codes when working with high voltage equipment.

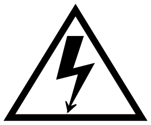
This symbol is associated with handling of combustible materials. Follow all local and state codes when working with flammable materials and liquids.



These symbols are associated with the handling of poisons and acids. Follow all local and state codes when working with caustic materials and liquids.

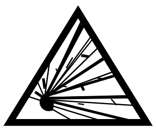
These symbols are associated with situations that may cause equipment to burst violently due to excessive pressures. Make sure systems are de-pressurized before attempting to work on them.

WARNING

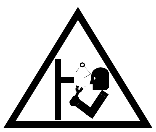


Voltages (up to 530 Vdc) capable of causing injury or death are present in the power supply. Avoid touching the connector sockets, tube pins, and other high voltage conductors. Servicing should be performed by qualified personnel only.

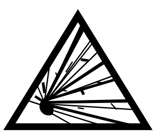
WARNING



Do not turn on the ionization gauge when there is danger of explosion from explosive or combustible gases, or gas mixtures. Ionization gauge filaments operate at temperatures sufficiently high to cause ignition.



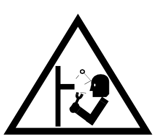
Install suitable devices that will limit the pressure from external gas sources to the level that the vacuum system can safely withstand. In addition, install suitable pressure relief valves or rupture discs that will release pressure at a level considerably below that pressure which the system can safely withstand.



Danger of injury to personnel and damage to equipment exists on all vacuum systems that incorporate gas sources or involve processes capable of pressurizing the system above the limits it can safely withstand.

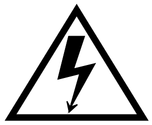
For example, danger of explosion in a vacuum system exists during backfilling from pressurized gas cylinders because many vacuum devices such as ionization gauge tubes, glass windows, glass bell jars, etc., are not designed to be pressurized.

Suppliers of pressure relief valves and pressure relief discs are listed in Thomas Register under "Valves, Relief", and "Discs, Rupture".



Confirm that these safety devices are properly installed before installing the Stabil-Ion Gauge. In addition, check that (1) the proper gas cylinders are installed, (2) gas cylinder valve positions are correct on manual systems, and (3) the automation is correct on automated systems.

WARNING



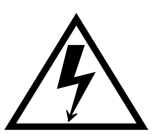
Safe operation of ion producing equipment, including the Stabil-Ion Gauge, requires grounding of both its power supply and the vacuum chamber. **Lethal voltages** may be established under some operating conditions unless correct grounding is provided.

Research at Granville-Phillips has established that ion producing equipment, such as ionization gauges, mass spectrometers, sputtering systems, etc., from many manufacturers may, under some conditions, provide sufficient conduction via a plasma to couple a high voltage electrode to the vacuum chamber. If conductive parts of the chamber are not grounded, they may attain a potential near that of the high voltage electrode during this coupling.

Potentially fatal electrical shock could then occur because of the high voltage between these chamber parts and ground.

During routine pressure measurement, using ionization gauge controllers from any manufacturer, high voltage may become present on ungrounded chambers at pressures near 10^{-3} Torr. All isolated or insulated conductive parts of the chamber must be grounded to prevent these voltages from occurring.

WARNING



Grounding, though simple, is very important! Please be certain that the ground circuits are correctly used, both on your ion gauge power supplies and on your vacuum chambers, regardless of their manufacturer, for this phenomenon is not peculiar to Granville-Phillips equipment. Refer to Chapter 2 - Installation, for additional information. If you have questions, or need additional labels or literature, contact the Customer Support Center.

Chapter 1

Introduction

1.1 General Description

The 347 Stabil-Ion Module is a compact vacuum Gauge controller that operates the Granville-Phillips Stabil-Ion Gauge. The system, consisting of a Module and a Gauge, measures pressures from 2 x 10^{-2} to 1 x 10^{-9} Torr. The Module is available with analog and RS-485 interface, as well as DeviceNet which is covered in this manual. Additional information on vacuum gauges and theory of operation can be found on our website www.brooks.com.

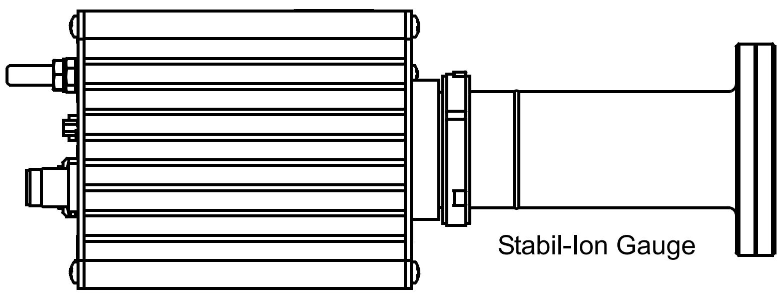


Figure 1-1: Stabil-Ion Vacuum Gauge and Module

1.2 Ion Gauge Basics

In a high vacuum system under molecular flow conditions, the rate at which electron collisions with molecules occur is proportional to the density of gas molecules, and hence the ion current is proportional to the gas density (or pressure, at constant temperature).

The amount of ion current for a given emission current and pressure depends on the ion gauge design. This gives rise to the definition of ion gauge sensitivity, frequently denoted by K:

$$K = \frac{\text{ION CURRENT}}{\text{EMISSION CURRENT x PRESSURE}}$$

There are two ranges of emission current available in the 347 Module. Either 100 microamperes or 4 milliamperes are available as determined by the computer interface. While either range can be used continuously, the following guidelines are suggested. For operation in the higher pressure ranges with a clean system 100 microamperes emission is recommended. This will give a theoretical longer filament life and allows usage to where the gauge pressure reading overlaps with other type transducers such as the Convectron or capacitance manometer. For operation in the lower pressure ranges, the 4 milliampere range should be used to give a more accurate pressure reading. Internal circuitry corrects the pressure output data for the emission current selected.

There is a problem with all ion gauges when used in systems which have the potential for diffusion pump oil vapor to enter the gauge tube. This oil vapor deposits on the grid forming an insulator and preventing emission resulting in higher and higher filament power being required and ultimate inability to control emission. In this situation the 4 milliampere position is recommended, as well as frequent degassing.

The Module varies the heating current to the filament to maintain a constant electron emission, and measures the ion current to the collector. From these current measurements, the pressure is calculated using the formula:

$$\text{PRESSURE} = \frac{\text{ION CURRENT}}{\text{K x EMISSION CURRENT}}$$

1.3 Module Overview

The Module contains the externally accessible connectors, buttons and indicators shown in Figure 1-1 and listed in Table 1-2.

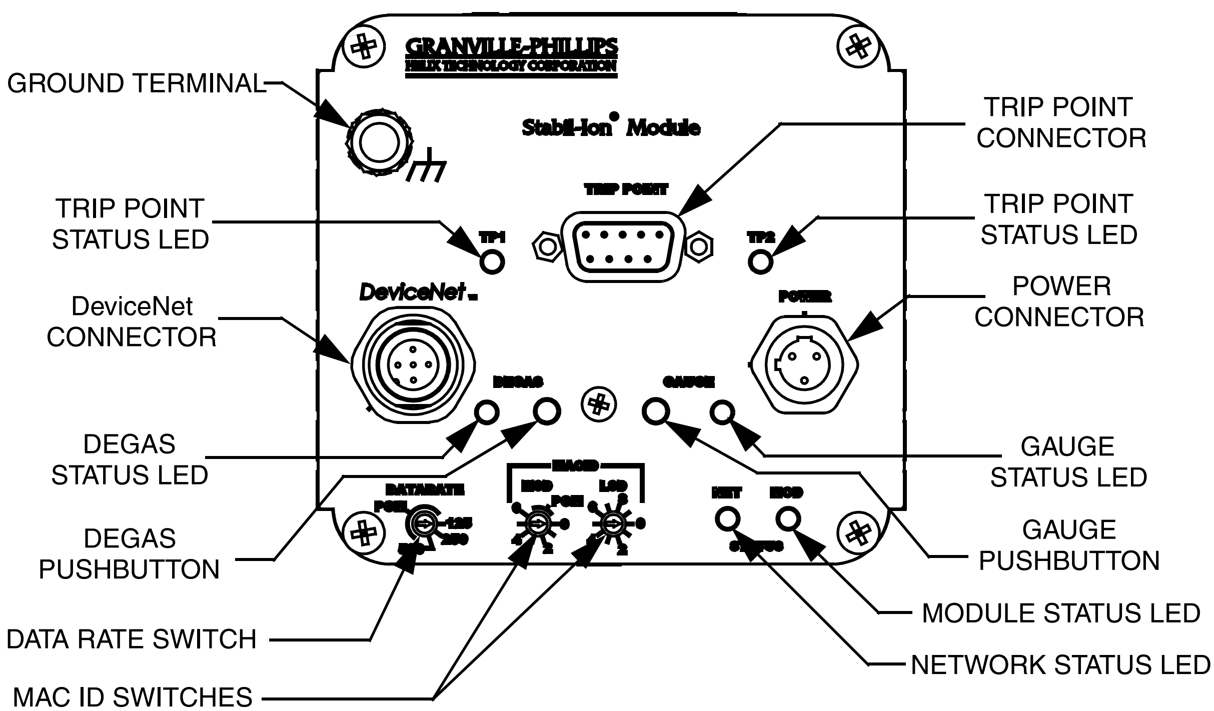


Figure 1-2: 347 Stabil-Ion Module

1.4 Specifications

The Module is CE compliant. The Module is only CE compliant if it is used with a CE compliant power supply. Table 1-1 lists the specifications for the Module.

Table 1-1: 347 Stabil-Ion Module Specifications

Parameter	Description
Measurement range for air or N_2 Torr mbar Pa	(see notes 1 and 2 below) 1×10^{-9} to 2×10^{-2} 1×10^{-9} to 3×10^{-2} 1×10^{-7} to 3
Emission Current	0.1 and 4 mA
Degas	Electron bombardment, 20 W with 2 minute timer
Overpressure Protection	Automatic overpressure shutdown
Operating Temperature	0 °C to 40 °C
Non-operating temperature	-40 °C to +70 °C
Humidity	< 90% RH non-condensing
Weight	800 gm (1 lb, 12.5 oz)
Housing	Aluminum extrusion
Mounting Position	Horizontal recommended
Input Power Required	24 Vdc ±15%, 75 W maximum, 3.75 A at 20 V
Trip-point relays	Two single-pole, double-throw (SPDT) (1 Form C) Contact Rating: 1 A at 30 Vdc resistive, 0.5 A at 125 VAC non-inductive Adjustments: Value, hysteresis, and direction set through software Relay Status: LED's indicate relay status Connector: 9-pin-D male
Display (optional)	4-digit LED display (3 digits & exponent). Units Torr, millibar, Pascal - selectable and indicated on display
CE Compliance	EMC Directive 89/336/EEC; EN 50081-2; EN 50082-2 Low Voltage Directive 73/23/EEC; EN 61010-1
Typical ground isolation between DeviceNet Ground and Chassis Ground	1 M Ω with Ground potential difference below ± 26 Vdc. Under 10 Ω with Ground potential difference above ± 30 Vdc.

Note 1: Measurements will change with different gases and mixtures. Correction ratios for common gases are provided in Table 3-12, Ion Gauge Sensitivity Ratios.

Note 2: Stabil-Ion Gauges are not intended for use with flammable or explosive gases.

Table 1-2: Module Connectors, Buttons, and Indicators

Feature	Description of Functionality
DeviceNet Connector	Section 2.2.1
Trip Point Connector and Indicator	Section 2.2.2
Power Connector	Section 2.2.3
Ground Terminal	Section 2.3.2
DeviceNet Data Rate Switch	Section 3.2.1
DeviceNet MAC ID Switches	Section 3.2.2
Gauge ON/OFF Button	Section 3.8
Gauge ON/OFF Indicator	Section 3.8
Degas Button	Section 3.11
Degas Indicator	Section 3.11
Pressure Display (Optional)	Section 3.14
Display Units (Optional)	Section 3.14.1
Display Orientation Button (Optional)	Section 3.14.2

Chapter 2

Installation

2.1 Introduction

This chapter provides installation information for the 347 Stabil-Ion Module and Stabil-Ion Gauge.

2.2 Pre-Installation

The Power cable, DeviceNet cable, and the Trip Point cable should be installed before installing the Module.

2.2.1 DeviceNet Connector

The Module contains a DeviceNet Micro Connector for interfacing to the customer supplied DeviceNet Cable with DeviceNet Micro Connector. The DeviceNet connector pin configuration is shown in Figure 2.1.

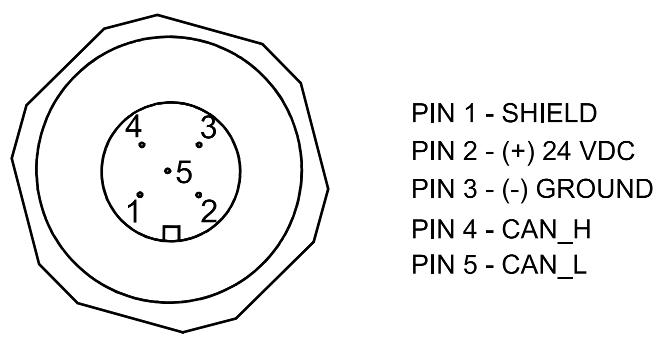
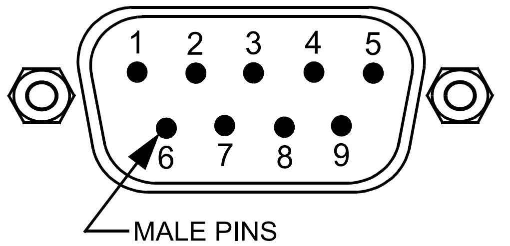


Figure 2-1: DeviceNet Micro Connector Pin Configuration.

2.2.2 Trip Point Connector

The Module contains two Trip Point Relays that can be set to actuate at any pressure within the Module pressure measurement range. The operation of the Trip Point Relays is described in Section 3.13 Trip Points and Indicators on page 37. Each relay is capable of switching up to 1 A at 30 Vdc. These relays are accessible through the 9 pin Trip Point Connector of the Module. A mating 9 pin connector is supplied with the Module. This connector can be attached to the customer supplied Trip Point Cable. The Trip Point connector pin configuration is shown in Figure 2-2.



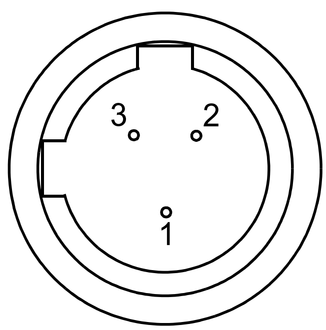
PIN 1 - TRIP POINT 2 (N.O.)
PIN 2 - TRIP POINT 2 - COMMON
PIN 3 - TRIP POINT 2 (N.C.)
PIN 4 - DO NOT USE - NO CONNECTION
PIN 5 - TRIP POINT 1 - COMMON
PIN 6 - TRIP POINT 1 (N.C.)
PIN 7 - TRIP POINT 1 (N.O.)
PIN 8 - DO NOT USE - NO CONNECTION
PIN 9 - DO NOT USE - NO CONNECTION

Figure 2-2: Trip Point Connector

2.2.3 Power Connector

The typical power supply for the Module is a customer supplied external +24 V +/-15 % power source. Power is supplied to the Module through a customer supplied power cable that is connected to a 3 pin circular power connector on the Module. A mating 3 pin connector is supplied for use on the power cable. The Power connector pin configuration is shown in Figure 2-3.

> ***NOTE:*** *For the Module to operate properly, pin 1 (Cable Sense) must be connected to pin 3 (Vdc Return) in the external +24 V cable. If pin 1 is not connected to pin 3, the Module will power the Gauge from the DeviceNet power and not use the external +24 V. This may overload the DeviceNet power supply on some systems.*



PIN 1 - CABLE SENSE
PIN 2 - (+) 24 Vdc
PIN 3 - (-) VDC (RETURN)

Figure 2-3: Power Connector Pin Configuration

> ***NOTE:*** *The power supply return should NOT be connected to ground. The power return is connected to the DeviceNet ground inside the Module. Grounding the power return will violate DeviceNet grounding requirements.*

2.2.4 Power Requirements

The following terms are used in this section:

Surge current – The maximum momentary current required by the Module when power is first applied. The Stabil-Ion Gauge is assumed to be OFF.

Operating current – the steady state current required during normal operation. The maximum operating current occurs during a degas cycle.

2.2.4.1 External +24 Vdc Power Supply

The Module is always powered from the DeviceNet connector, requiring less than 0.4 Adc. DeviceNet or an external +24 Vdc supply can power the Gauge. For uninterrupted, reliable operation, the Module should be powered from an external +24 Vdc +/-15%, 4 Adc max. power supply. The Gauge will require up to an additional 60 Watts during degas. This may be more than the DeviceNet can safely supply.

When the external +24 Vdc is connected to the Module, the Gauge will be powered from the external +24 Vdc supply. If the external +24 Vdc supply is powered OFF, the Gauge ON command will fail and an error will be reported on the DeviceNet. If the external +24 Vdc cable is disconnected, the Gauge will be powered by DeviceNet.

The +24 Vdc return on this power supply should NOT be connected to ground. Refer to Section 2.3.2 Grounding on page 21 for more information on grounding. Table 2-1 lists the operating and surge currents for the Module when powered by an external supply.

Table 2-1: Current Requirements with Module Powered through Power Connector

Connector	Surge Current	Operating Current During Degas	Operating Current Gauge ON, No Degas	Input Voltage
DeviceNet	1.3 A 20 ms	0.16 A	0.16 A	26 Vdc
DeviceNet	1.0 A 20 ms	0.31 A	0.31 A	11 Vdc
Power	0.5 A 20 ms	1.80 A	0.04 A	27.6 Vdc
Power	0.5 A 10 ms	2.72 A	0.04 A	20.4 Vdc

2.2.4.2 DeviceNet Powered Module

For those systems that cannot supply a separate +24 Vdc power supply, the Module can be powered through the DeviceNet connector. When operated in this mode, the DeviceNet voltage must not drop below 20.4 Vdc. If it does, the Gauge may shut down. DeviceNet communications will continue to work down to 11 Vdc per the DeviceNet specification.

The DeviceNet specification limits the input current to 3 Adc max. The Module monitors this current. The Module will require the most current during the degas cycle. If the current exceeds 3 Adc, the Gauge is shut-off. The required input current will increase as the DeviceNet supply voltage decreases.

During degas, the Module normally requires near 3 Amps, which is the DeviceNet maximum. Thus for uninterrupted operation, it is recommended that the module be powered from a separate power supply.

When powering the Module from DeviceNet, the external +24 V cable must be disconnected from the Module.

Table 2-2: Current Requirements with Module Powered From DeviceNet

Connector	Surge Current	Operating Current During Degas	Operating Current Gauge ON, No Degas	Input Voltage
DeviceNet	2.0 A 8 ms	3 A	1 A max	25 Vdc
DeviceNet	1.5 A 8 ms	3 A	1 A max	20 Vdc

2.3 Installation of the Stabil-Ion Gauge and Module

1. Locate the desired port on the vacuum chamber for installing the Gauge. The port should be such that the Module is not mounted directly above the Gauge. See Section 2.3 for more details.
2. Before mounting the Gauge, attach the Module to the Gauge. Orient the Module as desired. If the Module has the optional display, verify that it will be visible. If the display is upside down, it can be rotated electronically 180° after installation. Section 3.14.2 contains information on electronically rotating the display.
3. Noting the orientation of the Gauge from step 2, remove the Module from the Gauge and attach the Gauge to the chamber with the orientation determined in step 2.
4. Once the Gauge is installed, attach the Module to the Gauge as described in Section 2.3.3.
5. When the external +24 VDC supply or the DeviceNet is powered ON, the Module will be powered. The Gauge Status Indicator should be amber, indicating that the Module is powered and the Gauge is OFF.

For the Module to operate, pressure should be below 1 x 10^{-4} Torr to ensure the High Pressure Shut Down is not activated. This is described in more detail in Section 3.10. It is suggested that a degas cycle be performed before making pressure measurements. Refer to Section 3.11 for instructions on performing a degas cycle.

2.3.1 Physical Module Mounting and Orientation

The Module can be mechanically mounted anywhere on a system. To avoid damaging the module, do not mount the Module above the Gauge as shown in Figure 2-4. The Gauge generates heat, and the increased heat may damage the Module. The Module should be mounted in a location with free airflow and ambient temperature between 0 °C and 40 °C. If the Module contains a pressure display, consider display viewing when selecting a port. Reasonable care should be taken to install the Module in a location that protects it from physical damage.

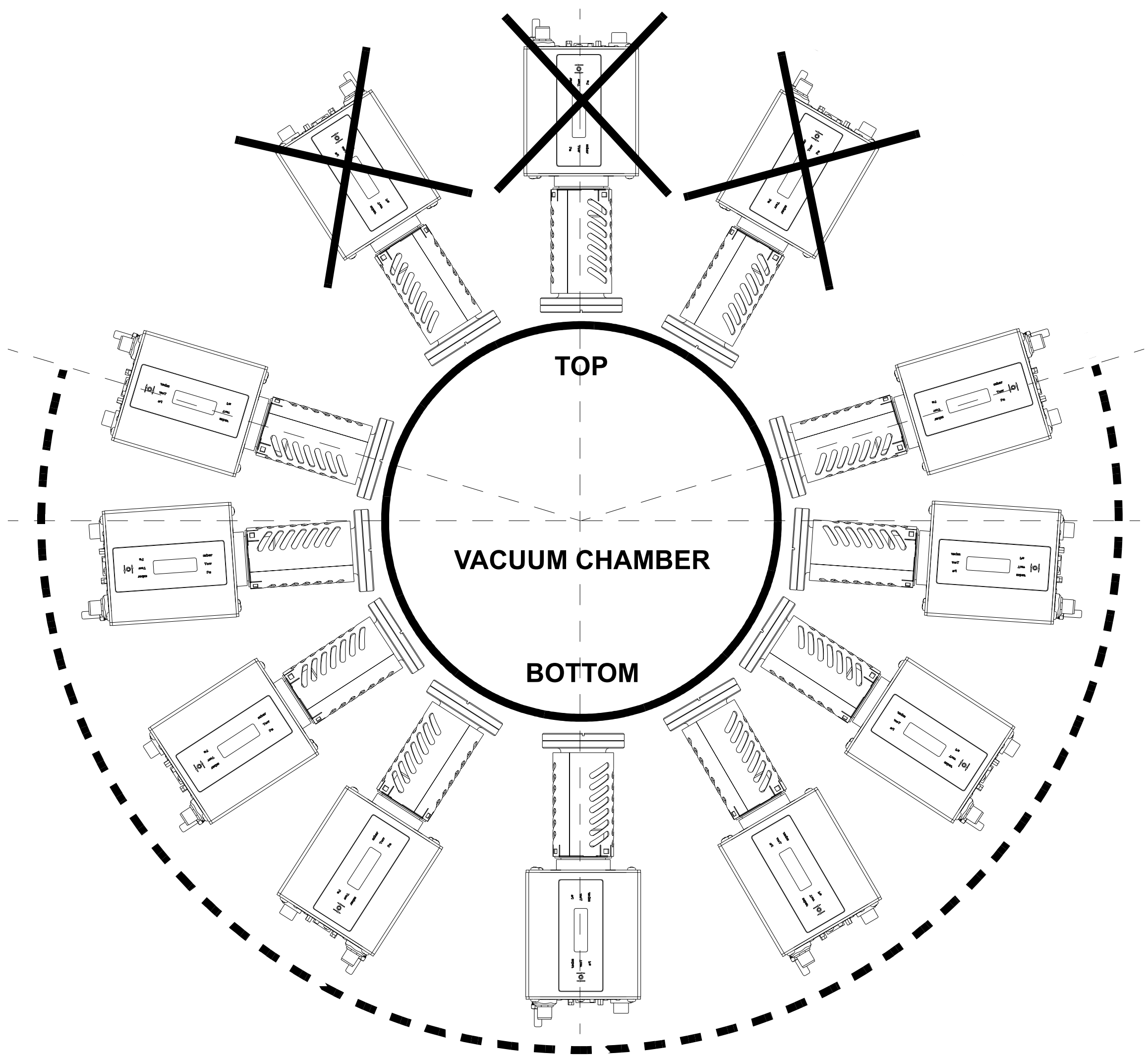


Figure 2-4: Acceptable 347 Module Mounting Angles

2.3.2 Grounding

The Module contains two separate and isolated grounds. These grounds are the DeviceNet ground and the Chassis ground. Typical isolation between these grounds is 1 MOhm up to +/-26Vdc, assuming the DeviceNet drain is grounded. Above 30V the isolation approaches zero ohms. The Module generates +180 Vdc during normal operation and 530 Vdc during degas. For safety and proper operation, the outer housing of the Module MUST be grounded to the vacuum chamber. This is accomplished by connecting the screw stud on the Module end plate to the vacuum chamber ground. Due to the insulated Gauge connector, grounding can not be assumed through the Gauge fitting. The screw stud should be connected to the vacuum chamber with AWG#18 (1mm^2) or larger wire.

2.3.3 Module Attachment

The Module is mounted directly on to the Gauge, relying on the Gauge for support. The Module is locked to the Gauge by the plastic locking ring. Use the following procedure to attach the Module to the Stabil-Ion Gauge. The following assumes the Gauge is already installed.

When performing the following steps, refer to Figure 2-5.

> **WARNING**
>
> To reduce the risk of being burned, make sure the heat shield is properly installed to shield the gauge from any human contact. Temperatures around 100 ºC have been observed during degas of Stabil-Ion gauges.

1. Align the slot on the heat shield with the elongated key on the locking ring. Gently push the heat shield toward the module until it snaps over the 3 locking tabs.

2. Align the keyway on the Gauge and the Module.

3. Insert the Gauge into the Module connector until the Gauge pins are inserted into the Module connector.

4. Twist clockwise, by hand, the gauge connector locking ring until the stop on the gauge collar in reached as shown in Figure 2-5. Do NOT over tighten the locking ring.

> **WARNING**
>
> Make sure the ground terminal on the module end plate is connected to the vacuum chamber ground system. Module grid supply voltages reach 530 Vdc during degas cycles.

1. Attach AWG 18 (1 mm^2) or larger wire between vacuum chamber and the Module ground lug. See Section 2.3.2 for additional information on grounding.

2. Connect the Trip Point cable to the Module Trip Point connector. See Section 2.2.2 for more information on the Trip Point Cable.

3. Connect the power cable to the Module power connector. See Section 2.2.3 for more information on the power cable.

4. Connect and secure the DeviceNet cable connector to the Module DeviceNet connector.

5. Power the Module and verify communication.

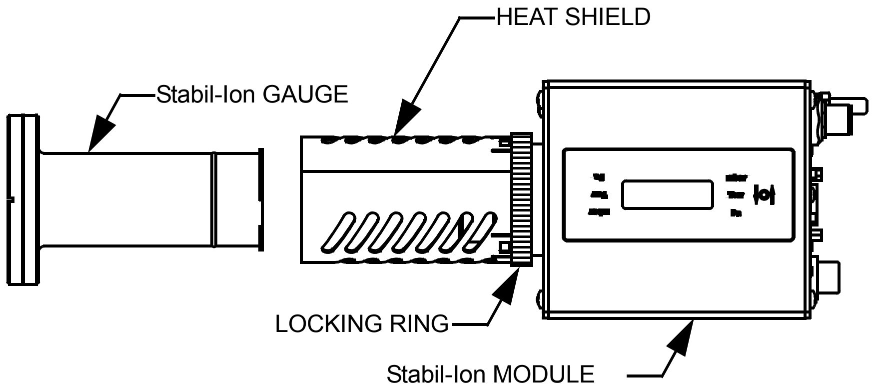


Figure 2-5: Module to Gauge Attachment

2.4 Module Removal

To remove the Module from the Gauge, follow the following procedure. When performing the following steps, refer to Figure 2-5.

1. Turn OFF power to the 347 Stabil-Ion Module.
2. Detach the DeviceNet cable from the module.
3. Detach the power cable from the module.
4. Detach the Trip Point cable from the module.
5. Detach the grounding wire from the grounding lug.
6. Twist counterclockwise, by hand, the gauge connector-locking ring until the ring hits the stop on the gauge collar.
7. While holding the flange, gently pull the 347 Stabil-Ion Module away from the Gauge as shown in Figure 2-5. The Gauge will disconnect from the module.

Chapter 3

Operation

3.1 Introduction

This chapter explains the configuration and operation of the Series 347 Stabil-Ion Module, and a summary of some of the DeviceNet commands needed to get the Module up and running. It is not a complete listing of all of the DeviceNet commands.

For the Module to operate, the pressure should be below 1 x 10^{-4} Torr to ensure the High Pressure Shut Down is not activated. This is described in more detail in Section 3.10.

The Module can be operated without DeviceNet communications. This operation is accomplished with externally accessible push buttons. If the module has the optional display, pressure can be read and the module operated as a stand-alone system.

Note: Refer to the Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide, G-P p/n 354022 for additional information on firmware configuration. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm.
Appendix A of this user manual lists all DeviceNet commands available on the 347 Module.

3.2 Device Communications

3.2.1 Data Rate Switch

The Data Rate Switch selects the rate at which data is sent and received on the DeviceNet network. When the Module is reset by either power being turned ON or by the network, the data rate switch position will be read by the module firmware. Available values are: 125 k, 250 k, and 500 k baud.

3.2.2 MAC ID Switches

The MAC ID Switches set the media access control identifier, which the network master uses to address the Module. When the Module is reset by either power being turned ON or by the network, the MAC ID switch position will be read by the module firmware. The addresses range from 0 - 63 (00x - 3Fx). Upon connection to the DeviceNet network, the Module requests a duplicate MAC ID check. If there is another device on the network with the same MAC ID, the Module will not join the network and the NET STATUS indicator will turn red. If the Module's MAC ID is unique, the NET STATUS indicator will be green.

3.2.3 Status LED's

The Status LED's indicate whether or not the Module or DeviceNet network has power and is functioning properly. Refer to Tables 3-1 and 3-2 for more information.

Table 3-1: Module (MOD) LED States

Module State	LED State	Description
Power OFF	OFF	No power applied to module.
Self Test	Flashing Green-Red	Module is in self test.
Operational	Green	Module is operating normally.
Unrecoverable Fault	Red	Module has detected an unrecoverable fault.

Table 3-2: DeviceNet (NET) LED States

Network State	LED State	Description
Not Powered Not On-Line	OFF	Module is not on-line The module has not completed the DUP_MAC_ID test yet. The module may not be powered, look at module status LED.
Self Test	Flashing Red/Green	Module is in self-test.
On-line, Not Connected	Flashing Green	Module has passed the Dup_MAC_ID test, is on-line, but has no established connections to other nodes. It means that the module has no established connections.
On-line, Connected	Green	The module is allocated to a Master. Device is operating normally.
Critical Link Failure	Red	Failed communication device. The module has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID or Bus-off).
Connection Time Out	Flashing Red	All connections have timed out.

3.3 DeviceNet Communications Configuration

Use the following procedure to configure DeviceNet communications for the Module.

1. Turn the external power supplies off.
2. Set the MAC ID switches on the Module to the correct address position for the vacuum chamber on which it is installed. See Section 3.2.2.
3. Set the data rate switch to the appropriate setting. See Section 3.2.1.
4. Turn the external power supplies on.
5. Allocate a connection for the Module to the network master as listed in Tables 3-3 and 3-4.

Table 3-3: Network Master Connection

Parameter	Service	Class	Instance	Allocation Choice	Master ID
Connection	4Bhex	3	1	3	0-63

Table 3-4: Allocation Choice Byte Contents

7*	6*	5*	4*	3*	2*	1	0
Reserved	Acknowledge Suppression	Cyclic	Change of State	Reserved	Bit Strobed	Polled	Explicit Message
* Not supported, Value = 0							

6. Configure the expected packet rate as listed in Table 3-5. The default expected packet rate for Explicit Messaging is 2.5 seconds. The default expected packet rate for I/O Messaging is 0 (none). If the data is requested at a slower rate, the expected packet rate must be changed or disabled to prevent the connection from expiring. The information in Table 3-5 will disable the expected packet rate.

Table 3-5: Disabling the Expected Packet Rate for Explicit Messaging

Parameter	Service	Class	Instance	Attribute	Data
Service	10hex	5	1	9	0

7. Next the Module is configured for Polled Input I/O Data Format as listed in Table 3-6. The Module can input data to the network in two different types of data and one type of status information. The default format inputs floating point pressure and one byte of status data.

Table 3-6: Configuring Polled Input I/O Data Format

Parameter	Service	Class	Instance	Attribute	Data
1 Byte Status and 4 Bytes Floating Pressure	10hex	4	0	65hex	05 (Default)
4 Bytes Floating Point Pressure	10hex	4	0	65hex	04
1 Byte Status and 2 Bytes Integer Pressure	10hex	4	0	65hex	02
2 Bytes Integer Pressure	10hex	4	0	65hex	01
These parameters are non-volatile, the setting will remain after power is cycled.					

8. Configure the Module to receive one byte of output data from the network to control the status of the Gauge as listed in Table 3-7. The default setting, is the 1 byte structure.

Table 3-7: Configuring Polled Output I/O Data Format

Parameter	Service	Class	Instance	Attribute	Data
Null	10hex	4	0	66hex	00
1 Byte Structure	10hex	4	0	66hex	01

3.3.1 Writing Polled I/O (Ion Gauge Control Data)

If the polled I/O data format is enabled, the master can output data to the device to control the Gauge status.

Table 3-8: Polled I/O - Writing Gauge Control Data

Assembly Number	One Byte Format							
1	Bit 7 High Emission	Bit 6 Ion Gauge	Bit 5 0	Bit 4 0	Bit 3 0	Bit 2 Enable Filament 2	Bit 1 Enable Filament 1	Bit 0 Degas

3.3.2 Ion Gauge Control Bits

1. Degas: When bit 0 is set to 1, degas will start if the Gauge is ON.
2. Enable Filament 1: When bit 1 is set to 1, filament 1 is selected the next time the Gauge is turned ON.
3. Enable Filament 2: When bit 2 is set to 1, filament 2 is selected the next time the Gauge is turned ON. If both bits 1 and 2 are set to 1, both filaments will be ON. If both bits 1 and 2 are set to 0, the last programmed value will be used to select the filaments.
4. Bits 3, 4 and 5 are reserved and should always be 0.
5. Ion Gauge: When bit 6 is set to 1, the Gauge will turn ON. If a fault occurs, the Gauge state will be OFF and an alarm generated. See Section 3.9 for alarm status. Once the alarm is cleared, this bit must be set to 0 and then to 1 to restart the Gauge.
6. High Emission: When bit 7 is set to 1, the emission current is high (4mA). When bit 7 is 0, the emission current is low (100μA).

Refer to the following sections for more information on the above functions.

3.3.3 Reading Polled I/O (Pressure)

Allow the vacuum chamber to acclimate to the correct vacuum pressure. When the Master polls the Module for data, the data returned is dependent on the Polled I/O data format configuration. The default format is assembly number 5, which inputs status (one byte) and pressure (floating point). Pressure data is available in the forms presented in Table 3-9.

Table 3-9: Available Pressure Data Format

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	INT Pressure Value (low byte)							
	1	INT Pressure Value (high byte)							
2	0	0	0	Warn Status	0	0	0	Alarm Status	0
	1	INT Pressure Value (low byte)							
	2	INT Pressure Value (high byte)							
4	0	REAL Pressure Value (low byte)							
	1								
	2	REAL Pressure Value (high byte)							
	3								
5	0	0	0	Warn Status	0	0	0	Alarm Status	0
	1	REAL Pressure Value (low byte)							
	2								
	3	REAL Pressure Value (high byte)							
	4								

3.4 Factory Default Settings

The Module is shipped with the default settings listed in Table 3-10.

> ***NOTE:*** *If a reset command is issued, the settings are reset to the values listed in Table 3-10.*

Table 3-10: Factory Default Settings

Function	Default State
Gauge On/Off Button Disable	Button Enabled
Degas Button Disable	Button Enabled
Filament Auto Select	Off
Filament Selected	Filament 1
Auto emission current selection	On
Auto emission threshold pressure and emission current.	Below 1 x 10^{-5} Torr = 4 mA Above 5 x 10^{-5} Torr = 100 μA
Sensitivity	43/Torr (4 mA) 49/Torr (100 μA)
Display Orientation	Non-inverted
Set Point 1 Pressure	1 x 10^{-5} Torr
Set Point 2 Pressure	1 x 10^{-6} Torr
Set Point Relay State	Disabled – Off
Set Point Pressure Hysteresis	20%
Set Point Relay Active State	Common to NO
Pressure Units	Torr (unless otherwise specified)

These functions are described in more detail in the following sections.

3.5 Sensitivity

The sensitivity of the Gauge must be used to calculate the pressure. Set the Sensitivity as described in the *Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide, G-P p/n 354022*. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm. Sensitivity is set for each emission range to improve the measurement accuracy of the Module. The standard Sensitivities for the Gauge are listed in Table 3-11.

Table 3-11: Sensitivities for Various Stabil-Ion Gauges

Gauge	Filament	4mA Emission	100 μA Emission
Extended Range	Yttria-coated Iridium	43/Torr	49/Torr
	Tungsten	39/Torr	42/Torr
UHV	Yttria-coated Iridium	18/Torr	21/Torr
	Tungsten	17/Torr	20/Torr

3.5.1 Relative Gas Sensitivities

Sensitivity depends on the gas being measured as well as the type of IG tube. Table 3-12 lists the relative gauge sensitivities for common gases. These values are from NASA Technical Note TND 5285, *Ionization Gauge Sensitivities as Reported in the Literature*, by Robert L. Summers, Lewis Reasearch Center, National Aeronautics and Space Administration. Refer to this technical note for further definition of these average values and for the gauge sensitivities of other gases.

To calculate the sensitivity S_x for gas type x:

$S_x = (R_x)\ (SN_2)$

Where SN_2 is the gauge sensitivity for N_2 and R_x is found from Table 3-12.

Table 3-12: Ion Gauge Sensitivity Ratios

Gas	R_x	Gas	R_x
He	0.18	H_2O	1.12
Ne	0.30	NO	1.16
D_2	0.35	Ar	1.29
H_2	0.46	CO_2	1.42
N_2	1.00	Kr	1.94
Air	1.00	SF6	2.50
O_2	1.01	Xe	2.87
CO	1.05	Hg	3.64

To correct for changes in sensitivity due to gas composition, apply the corrections as shown above.

3.5.2 Example of Gas Sensitivity Calculation

The output indicates a pressure of 5×10^{-5} Torr. If the gas is known to be Neon, then the actual pressure is:

$$\frac{5 \times 10^{-5}}{0.30} = 1.667 \times 10^{-4} \text{ Torr of Neon}$$

The calculated gas sensitivity correction can be programmed into the system master controller if desired.

3.6 Emission

The Module can operate the Gauge at two filament emission settings. These are 100 µA and 4 mA. The 4 mA emission is used at low pressures, typically under 1×10^{-5} Torr. At higher pressures, the 100 µA emission is used. Refer to Section 1.2 Ion Gauge Basics on page 13 for a description of how the pressure reading relates to the emission current.

Emission can be set to 4 mA, 100 µA or automatic. The automatic setting will automatically switch to 4 mA below 1×10^{-5} Torr and to 100 uA above 5×10^{-5} Torr. The threshold pressure can be changed as described in the *Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide, G-P p/n 354022*. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm. Table 3-13 describes the commands for selecting the type of emission.

Table 3-13: Configuring Emission

Parameter	Service	Class	Instance	Attribute	Data
Enable Automatic Emission Ranging	10hex	35hex	3	6	1
Disable Automatic Emission Ranging	10hex	35hex	3	6	0
Manually Set Emission to 100µA	10hex	31hex	1	5Bhex	17 B7 D1 38 hex
Manually Set Emission to 4mA	10hex	31hex	1	5Bhex	6F 12 83 3B hex
These parameters are non-volatile, the setting will remain after power is cycled.					

3.7 Filament Selection

The Gauge contains two filaments. Normally one filament is operated and the other reserved as a spare. The filaments can be selected using the commands in Table 3-14.

Table 3-14: Filament Selection

Parameter	Service	Class	Instance	Attribute	Data
Select Both Filaments	10hex	31hex	1	59hex	3
Select Filament 1	10hex	31hex	1	59hex	1
Select Filament 2	10hex	31hex	1	59hex	2
These parameters are non-volatile, the setting will remain after power is cycled.					

3.7.1 Automatic Filament Selection

Automatic filament selection is available on the Module. If one filament fails and automatic filament selection is active, the Module will automatically switch to the other Filament.

CAUTION

The automatic filament selection should be used with great care. If the Gauge is at a high pressure and the active filament burns out, the Module will switch to the remaining filament and the high pressure will probably burn it out also.

Note: Refer to the Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide, G-P p/n 354022 for the DeviceNet commands to activate the automatic filament selection. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm.

3.8 Gauge ON/OFF Command, Button, and Indicator

The Module is always ON when powered. To measure pressure, the Gauge (ilament) must be turned ON. The Gauge Indicator, indicates if the Gauge is ON or OFF as shown in Table 3-15.

Table 3-15: Gauge Status Indicator

State	LED Color
Gauge ON	Green
Gauge OFF	Amber

When the Module is first powered ON, the Gauge is off. The Gauge can be turned ON and OFF by pressing the Gauge button or by sending the DeviceNet commands shown in Table 3-16.

Table 3-16: Gauge ON/OFF Commands

Parameter	Service	Class	Instance	Data
Turn Gauge ON	62hex	31hex	1	1
Turn Gauge OFF	62hex	31hex	1	0

After the Gauge has been ON for three seconds, the measured pressure will be within 10% of its final value. To preserve filament life, the Gauge should be shut OFF before increasing the pressure above the operating range of the Gauge.

3.9 Module Alarm Status

An alarm is reported if the Module shuts OFF due to one of the faults in Table 3-17. The alarm status can be read and reset using the commands in Table 3-18.

Table 3-17: Alarm Conditions

Bit Weight	Alarm Condition
0	Filament 1 Failure
1	Filament 2 Failure
9	Primary Over Current
10	High Voltage Failure
12	Over Pressure Shutdown

Table 3-18: Module Alarm Status

Parameter	Service	Class	Instance	Attribute	Data
Check Status	0Ehex	31hex	1	5Fhex	Unsigned integer, 2 bytes*
Reset Alarm	63hex	31hex	1	-	-
*Refer to the *Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide, G-P p/n 354022* for more information. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm					

3.10 High Pressure Shut Down

To prevent Gauge damage, the Module has a *high pressure shut down*. For 100 µA emission current, the Gauge shuts off above 2 x 10^{-2} Torr. For 4 mA emission current, the Gauge shuts off above 5 x 10^{-4} Torr. When the overpressure shutdown is activated, a message is sent to DeviceNet as described in the *Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide, G-P p/n 354022*. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm.

> ***NOTE:*** *For optimum filament lifetime, a Gauge OFF command should be used to turn off the Gauge prior to venting, rather than letting the High Pressure Shutdown turn it off.*

3.11 Degas ON/OFF Command, Button, and Indicator

Pump oil, other organic compounds, or metal coatings (such as from a sputtering process) can cause electrical current leakage between the Ion Gauge tube elements. When contamination occurs, system base pressure readings may begin to rise, which is an indication that a degas (outgas) cycle will have to performed.

The removal of surface contaminates from the Gauge tube is accomplished by electron bombardment (EB) heating of the grid. Pressure readings are provided during a degas cycle.

> ***NOTE:*** *The Gauge must be turned ON before a degas cycle can be initiated. This ensures that there is a vacuum in the system prior to the degas cycle.*

The pressure must be below 5 x 10^{-5} Torr to initiate a degas cycle. As the contaminates are removed, the pressure will increase. It is not uncommon for the pressure to increase above 5 x 10^{-5} Torr, and the Gauge to shut OFF.

If this occurs, continually initiate a degas cycle until the pressure remains below the *high pressure shut down*.

The degas cycle can be initiated manually by pressing the degas button, or by using the DeviceNet command described in the *Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide, G-P p/n 354022*. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm. Once started, the degas cycle will terminate automatically after 2 minutes. Pressing the degas button during a degas cycle will terminate the degas cycle. Table 3-19 show the DeviceNet commands for initiating a degas cycle.

Table 3-19: Degas Commands

Function	Service	Class	Instance	Data
Turn Stabil-Ion Module ON	62	31	1	1
Turn DEGAS Cycle ON	61	31	1	1

The degas button is beside the degas indicator. The degas status is indicated as shown in Table 3-20.

Table 3-20: Degas Status Indicator

State	LED Color
Degas Cycle ON	Green
Degas Cycle OFF	Amber

Once the degas cycle is complete, check the system base pressure reading again. If the reading is still high, repeat this procedure until the system base pressure is within its normal range. Depending upon the level of contamination, several degas cycles may be required to remove the contamination from the Gauge.

For most processes, regular periodic degas cycles are recommended, to reduce accumulation of contaminants in the Gauge.

3.12 UHV Bake Out

To obtain the best results, Helix Technology Corporation recommends the following when measuring vacuum pressures below 1 x 10^{-7} Torr:

- Use only all-metal vacuum fittings
- Degas the Module. Refer to Section 3.11 for more information.
- A process chamber bake between 100 and 150 ºC is often required. This process is described in the following section.

NOTE: *The Module can be removed from the* Gauge *without interrupting the vacuum within the process chamber.*

CAUTION

The temperature of the Module cannot exceed 70 ºC (40 ºC operating). The Module must be removed from the Gauge before baking the chamber at temperatures higher than 70 ºC.

WARNING

To prevent electrical shock, turn OFF electrical power before servicing the Module. Do not touch any Gauge pins while the Gauge is under vacuum or connected to a controller.

NOTE: *When baking the process chamber, make sure the temperature of the Gauge and the associated vacuum plumbing is raised to the same temperature as the process chamber.*

1. Remove the module as described in Section 2.4.
2. Bake the process chamber at the desired temperature for the specified period of time.
3. Once the chamber has cooled to below 70 ºC (158 ºF), attach the Module to the Gauge as described in Section 2.3.3.
4. Once the vacuum system temperature is below 40 ºC (104 ºF), turn Module power ON and verify communication.

3.13 Trip Points and Indicators

The Module contains two Trip Point relays capable of switching 30 VDC at 1 Amp. These relays can be used to control various devices such as safety interlocks, valves, or programmable logic controllers. Refer to Section 2.2.2 for the pin configuration of the Trip Point connector. Each relay can be configured using the commands in Table 3-21.

Table 3-21: Trip Point Commands

Parameter	Service	Class	Instance	Attribute	Data
Disable Trip Point Relay 1	10hex	35hex	1	6	0
Normal Polarity Trip Point 1	10hex	35hex	1	8	0
Reversed Polarity Trip Point 1	10hex	35hex	1	8	1
Trip Point Pressure Trip Point 1 1 e^{-6} Torr	10hex	35hex	1	5	BD 37 86 35hex
Enable Trip Point Relay 1	10hex	35hex	1	6	1
Disable Trip Point Relay 2	10hex	35hex	2	6	0
Normal Polarity Trip Point 2	10hex	35hex	2	8	0
Reversed Polarity Trip Point 2	10hex	35hex	2	8	1

Normally the relays are OFF at high pressure and ON at low pressure. This can be reversed using the Reversed Polarity commands in Table 3-21. The Trip Point pressure can be changed as described in the *Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide, G-P p/n 354022*. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm.

Each Trip Point relay has an indicator to indicate the relay status as shown in Table 3-22.

Table 3-22: Trip Point Indicator States

State	LED Color
Trip Point Relay ON	Green
Trip Point Relay OFF	OFF

3.14 Optional Display

An optional LED display is available of the form X.XX-E. Where X.XX are the three most significant digits of the pressure, and E is the exponent.

3.14.1 Units Indicator

The pressure can be displayed in mBar, Torr, or Pascal. The desired unit of measure can be set by the appropriate DeviceNet command as described in the *Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide, G-P p/n 354022*. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm. The display will indicate which unit of measure has been selected by turning on the proper indicator to the right of the display. The unit indicator will always be ON, even when the Gauge is OFF.

3.14.2 Display Orientation Button

Since the Module is normally mounted horizontally, it is possible that the display may appear up side down. For convenience, the display can be rotated 180 degrees by pressing the recessed orientation button (↑↓) beside the display.

Chapter 4

Service and Maintenance

4.1 Manual Operation

The Series 347 Stabil-Ion Module will operate without DeviceNet communications. This is very useful in troubleshooting. A Module with optional display and the power cable connected should read pressure when the Ion gauge ON button is pressed, assuming sufficient vacuum exists for normal operation.

> ***NOTE:*** *The Network LED will be RED to indicate a bus-off condition when there is no DeviceNet communications.*

4.2 Troubleshooting Procedures

Table 4-1 presents problems along with possible causes and corrective actions.

Table 4-1: Troubleshooting Procedures

Problem	Possible Cause	Corrective Action
Unit does not respond to DeviceNet communication from a Master but the MOD Indicator is solid green:	1. Address rotary switches set to incorrect address positions. 2. Incorrect baud rate programmed. 3. Incorrect data format programmed.	1. Set the address rotary switches to the correct address positions. 2. Set the baud rate switch to the correct position. 3. Set the Polled Input & Output I/O Data Format as described in Table 3-6.
MOD indicator does not light:	1. DeviceNet power supply disconnected, off, or inadequate for load.	A switching supply may shut down from the current surge upon power up. If a switching power supply is used, size current limit to two times working load. Refer to Table 2-1 for power requirements.
Module will not stay on (always reads 9.99e+09).	1. Fault condition indicated by reading response to status attribute.	1. Refer to Table 3-15 for DeviceNet command to check status. 2. Refer to Table 4-2 in the *Mini-Convectron, Micro-Ion and Stabil-Ion Vacuum Gauge Module DeviceNet Programmer's Guide G-P p/n 354022* for status bit definitions. The guide can be downloaded at http://www.brooks.com/pages/3064_module_manuals.cfm.

Table 4-1: Troubleshooting Procedures (Continued)

Problem	Possible Cause	Corrective Action
Inaccurate pressure reading:	1. Organic seals. If the Gauge connection to the vacuum system is sealed with an organic O-ring, the gauge will not read accurately below 1 x 10^{-7} Torr. 2. Mechanical damage. If the unit is dropped or excessive force is applied to the vacuum connection during installation, gauge elements may be damaged or pin leaks may occur. 3. Contamination. Pump oil and other organic compounds or metal coating from a sputtering process can cause electrical current leakage between Gauge elements.	1. Replace O-ring with a metal seal. 2. Replace the Gauge. 3. Degas the Gauge by setting DEGAS state = 1. Refer to Section 3.11. Several degas cycles may be required to decontaminate the Gauge. If this does not work, the Gauge may be heated externally with the Module removed.
Process control Trip Point does not function as expected.	1. The Trip Point connector may be wired incorrectly. 2. Wrong Trip Point values programmed. ***NOTE:*** *The process control Trip Point will always have the COMMON contact connected to the N.C.* contact when the Module is off or when the unit is not powered.	1. Refer to Trip Point Cable Connections in Section 2.2.2. 2. Read programmed Trip Point values. If Trip Point values are incorrect, program the proper values. Refer to Section 3.13.
The Gauge shuts OFF during degas	1. The pressure has increased above 5 x 10^{-5} Torr. 2. The DeviceNet Current requirement is over 3.0 Amps.	1. Repeat degas procedure until the pressure remains below 5 x 10^{-5} Torr for the entire cycle. 2. Try an external +24 V, 4 A dc power supply to reduce the DeviceNet current requirement. 3. Replace the Gauge.

4.3 Stabil-Ion Gauge Replacement

1. Remove the Module from the Gauge as described in Section 2.4.

2. Remove the Gauge from the vacuum chamber.

3. Install the new Stabil-Ion Gauge. Refer to the Section 2.3 for more information.

4. Attach the Module to the Gauge as described in Section 2.2.3.

4.4 Returning a Module for Service

If the module must be returned to the factory for service, request a Return Authorization (RA) from Brooks Automation / Granville-Phillips. Do not return products without first obtaining an RA. In some cases a hazardous materials document may be required. The Brooks Automation / Granville-Phillips Customer Service Representative will advise you if the hazardous materials document is required.

When returning equipment to Brooks Automation / Granville-Phillips, be sure to package the products to prevent shipping damage. Circuit boards and modules separated from the controller chassis must be handled using proper anti-static protection methods and must be packaged in anti-static packaging. Brooks Automation / Granville-Phillips will supply return packaging materials at no charge upon request. Shipping damage on returned products as a result of inadequate packaging is the Buyer's responsibility.*Before you return the module*, obtain an RA number by contacting Granville-Phillips customer service:

- Phone **1-303-652-4400** or **1-800-776-6543** within the USA.
- Phone **1-800-367-4887** 24 hours per day, seven days per week within the USA.
- Email *co-csr@brooks.com*
- For Global Customer Support, go to www.brooks.com, click on Contact Us, then click on Global Offices to locate the Brooks Automation office nearest you.

Appendix A

Series 347 Stabil-Ion Module DeviceNet Objects

Introduction

The DeviceNet Objects listed in Tables 1 through 9 are specific to the operation of the Module.

Table 1: Identity Object

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex	1	1	1	None	00 03	UINT	Vendor Description	Open
0Ex	1	1	2	None	00 5Cx	UINT	Product Type	Open
0Ex	1	1	3	None	00 1Cx	UINT	347 Product ID	Open
0Ex	1	1	4	None	01 01	STRUCT	Firmware Revision	Open
0Ex	1	1	5	None	00 00	WORD	Status and Fault Information	Open
0Ex	1	1	6	None	00 00 00 00	UDINT	Serial Number	Open
0Ex	1	1	7	None	GP347	S_STRING	Identification	Open
5	1	1	None	None	None		Reset Service	Open

Table 2: DeviceNet Object

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex	3	0	1	None	00 02	UINT	Object Revision	Open
0Ex 10x	3	1	1	None 00	00 Success	USINT	Get Node Address, range 0-63 Set Node Address if switch set to PGM	Open
0Ex	3	1	2	None 00	00 Success	USINT	Get Baud Rate, range 0-2 Set Baud Rate if switch set to PGM	Open
0Ex 10x	3	1	3	None 00	00 Success	Bool	Get Bus-Off Interrupt, range 0-1 Set Bus-Off Interrupt	Open
0Ex 10x	3	1	4	None 00	00 Success	USINT	Get Bus-Off Counter, range 0-255 Set Bus-Off Counter	Open
0Ex	3	1	5	None	00 00	STRUCT	Get Allocation Choice, 0-3 and Master ID, range 0-63	Open
4Bx	3	1	None	03 00	Success	STRUCT	Allocate Choice, 0-3 and Master ID, range 0-63	Open
4Cx	3	1	None	03	Success	BYTE	Release Allocation, range 0-3	Open

Table 3: Assembly Object

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex 10x	4	0	65x	None 05	05 Success	USINT	Get I/O Instance Selection, range 1,2,4 and 5 Set I/O Instance Selection	Vendor
0Ex 10x	4	1	3	None 00	00 00 Success	UINT BYTE	Get Integer Pressure Data Set Gauge Status	Open Vendor
0Ex	4	2	3	None	00 00 00	STRUCT	Get Byte Status and UINT Pressure Data	Open
0Ex	4	4	3	None	00 00 00 00	UINT	Get REAL Pressure Data	Open
0Ex	4	5	3	None	00 00 00 00 00	STRUCT	Get Byte Status and REAL Pressure	Open

Table 4: Connection Object, Explicit Message Connections

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex	5	1	1	None	00	USINT	Get State of the Object, range 0-5	Open
0Ex	5	1	2	None	00	USINT	Get Instance Type, Explicit	Open
0Ex	5	1	3	None	83x	BYTE	Get Transport Class Trigger	Open
0Ex	5	1	4	None	04	USINT	Get Produced Connection ID	Open
0Ex	5	1	5	None	04	USINT	Get Consumed Connection ID	Open
0Ex	5	1	6	None	21x	BYTE	Get Initial Comm Characteristics	Open
0Ex	5	1	7	None	16 00	UINT	Get Produced Connection Size	Open
0Ex	5	1	8	None	16 00	UINT	Get Consumed Connection Size	Open
0Ex 10x	5	1	9	None 00 00	C4x 09 Success	UINT	Get Expected Packet Rate, range 0-65535 Set Expected Packet Rate	Open
0Ex 10x	5	1	0Cx	None 00	01 Success	USINT	Get Watchdog Time-out Action, 1 or 3 Set Watchdog Time-out Action	Open
0Ex	5	1	0Dx	None	04 00	UINT	Get Produced Connection Path Length	Open
0Ex	5	1	0Ex	None	04	EPATH	Get Produced Connection Path	Open
0Ex	5	1	0Fx	None	04 00	UINT	Get Consumed Connection Path Length	Open
0Ex	5	1	10x	None	04	EPATH	Get Consumed Connection Path	Open
0Ex	5	1	11x	None	00 00	UINT	Get Production Inhibit Time	Open
0Ex	5	1	None	None	Success	None	Rest Inactivity/Watchdog Timer	Open

Table 5: Connection Object, I/O Connections

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex	5	1	1	None	00	USINT	Get State of the Object, range 0-5	Open
0Ex	5	2	2	None	01	USINT	Get Instance Type, I/O	Open
0Ex	5	2	3	None	82x	BYTE	Get Transport Class Trigger	Open
0Ex	5	2	4	None	05	USINT	Get Produced Connection ID, 1 or 2 or 4 or 5	Open
0Ex	5	2	5	None	01	USINT	Get Consumed Connection ID, 0 or 1	Open
0Ex	5	2	6	None	01x	BYTE	Get Initial Comm Characteristics	Open
0Ex	5	2	7	None	05 00	UINT	Get Produced Connection Size	Open
0Ex	5	2	8	None	01 00	UINT	Get Consumed Connection Size	Open
0Ex 10x	5	2	9	None 00 00	00 00 Success	UINT	Get Expected Packet Rate, range 0-65535 Set Expected Packet Rate	Open
0Ex 10x	5	2	0Cx	None 00	00 Success	USINT	Get Watchdog Time-out Action Set Watchdog Time-out Action	Open
0Ex	5	2	0Dx	None	06 00	UINT	Get Produced Connection Path Length	Open
0Ex	5	2	0Ex	None	05	EPATH	Get Produced Connection Path, 1 or 2 or 4 or 5	Open
0Ex	5	2	0Fx	None	06 00	UINT	Get Consumed Connection Path Length	Open
0Ex	5	2	10x	None	01	EPATH	Get Consumed Connection Path, 0 or 1	Open
0Ex 10x	5	2	64x	None 00	00 Success	BYTE	Get Dynamic Size, 0 or 1 (1=default) Set Dynamic Size	Open

Table 6: Device Supervisor Object

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex	30x	1	3	None	VG	SSTRING	Get Device Type	Open
0Ex	30x	1	4	None	E54-0097	SSTRING	Get Revision Level, SEMI S/A Standard	Open
0Ex	30x	1	5	None	“”	SSTRING	Get Mfg. Name, GRANVILLE-PHILLIPS	Open
0Ex	30x	1	6	None	347032	SSTRING	Get Mfg. Model Number	Open
0Ex	30x	1	7	None	1.01	SSTRING	Get Software Revision Level	Open
0Ex	30x	1	8	None	1.01	SSTRING	Get Hardware Revision Level	Open
0Ex	30x	1	0Bx	None	04	USINT	Get Device Status	Open
0Ex	30x	1	0Cx	None	00	BYTE	Get Exception Status	Open
0Ex 10x	30x	1	0Fx	None 00	00 Success	BOOL	Get Alarm Enable Set Alarm Enable	Open
0Ex 10x	30x	1	10x	None 00	00 Success	BOOL	Get Warning Enable Set Warning Enable	Open
05x	30x	1	None	None	Success	None	Reset Device	Open
06x	30x	1	None	None	Success	None	Start Device Execution (no effect on 347)	Open
4Bx	30x	1	None	None	Success	None	Abort Device Activity (no effect on 347)	Open
4Cx	30x	1	None	None	Success	None	Recover from Abort State (no effect on 347)	Open
4Dx	30x	1	None	None	Success	None	Perform Diagnostics (no effect on 347)	Open

Table 7: Analog Sensor Object

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex	31x	1	4	None	01 03	UINT	Get Data Units, 769, 776 or 777	Open
0Ex	31x	1	5	None	01	BOOL	Get Reading Valid, 0 or 1	Open
0Ex	31x	1	6	None	00 00 00 00	REAL	Get Pressure Reading	Open
0Ex	31x	1	7	None	00	BYTE	Get Status, Alarm or Warning	Open
0Ex	31x	1	0Bx	None	CAx	USINT	Get Offset Data Type	Open
0Ex	31x	1	0Cx	None	00 00 00 00	REAL	Get Offset Value	Open
0Ex	31x	1	0Dx	None	CAx	USINT	Get Gain Data Type	Open
0Ex	31x	1	0Ex	None	00 00 00 00	REAL	Get Gain Value	Open
0Ex	31x	1	0Fx	None	00 00 00 00	REAL	Get Unity Gain Reference	Open
0Ex	31x	1	11x	None	00 00 00 00	REAL	Get Alarm Trip Point, over pressure point	Open
0Ex 10x	31x	1	23x	None 00 00	00 00 Success	UINT	Get Gas Calibration Instance Set Gas Calibration Instance	Open
0Ex 10x	31x	1	58x	None 00 00	00 00 Success	BOOL	Get Degas State Set Degas State, 0=OFF, 1=ON	Open Vendor
0Ex 10x	31x	1	59x	None 00 00	00 00 Success	USINT	Get Active Filament, bit0 - fil1, bit1 = fil2	Open
0Ex 10x	31x	1	5Ax	None 00 00 00 00	00 00 00 00 Success	REAL	Get Gauge Sensitivity Set Gauge Sensitivity	Open
0Ex 10x	31x	1	5Bx	None 00 00 00 00	00 00 00 00 Success	REAL	Get Emission Current Set Emission Current	Open
0Ex 10x	31x	1	5Cx	None 00	00 Success	BOOL	Get Filament Mode, 0=user, 1=automatic Set Filament Mode	Open Vendor

Table 7: Analog Sensor Object

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex 10x	31x	1	5Dx	None 00	00 Success	BOOL	Get Gauge State Set Gauge State, 0=off 1=on	Open
0Ex	31x	1	5Fx	None	00 00	UINT	Get Sensor Alarm	Open
05x	31x	1	60x	None	01	BYTE	Get Status Extension	Open
06x	31x	1	63x	None	05 00	UINT	Get Subclass Number	Open
61x	31x	1	None	00	Success	USINT	Set Degas State, 0=off, 1=on	Open
62x	31x	1	None	00	Success	USINT	Set Gauge State, 0=off, 1=on	Open
63x	31x	1	None	None	Success	None	Clear Emission Off Alarm	Open

Table 8: Gas Calibration Object

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex	34x	1	3	None	13 00	UINT	Get GAs Type Number	Open
0Ex	34x	1	4	None	01	UINT	Get Valid Sensor Object Instance	Open

Table 9: Trip Point Object

Service	Class	Instance	Attribute	Master Data	Device Data	Data Type	Description	Type
0Ex 10x	35x	1	5	None 00 00 00 00	13 00	REAL	Get Trip Point Value, Controlling Relay 1	Open
0Ex 10x	35x	1	6	None 00	00 Success	BOOL	Get Trip Point Enable, 0=Disbaled, 1 = Enabled Set Trip Point Enable	Open
0Ex	35x	1	7	None	00	BOOL	Get Trip Point Status	Open
0Ex 10x	35x	1	8	None 00	00 Success	BOOL	Get Polarity, 0=Normal, 1=Reversed Set Polarity	Open
0Ex	35x	1	9	None	00	USINT	Get Override Status, 0=Normal, 1=Force False	Open
0Ex 10x'	35x	1	0Ax	None 00	00 00 00 00 Success	REAL	Get Hysteresis, a Percentage of Pressure Set Hysteresis	Open

Index

Series 347

Granville-Phillips® Series 347 Stabil-Ion® Vacuum Gauge Module with DeviceNet™ Interface

BROOKS AUTOMATION

6450 Dry Creek Parkway
Longmont, CO 80503 USA
Phone: 1-303-652-4400

15 Elizabeth Drive
Chelmsford, MA 01824 USA
Phone: 1-978-262-2400

Worldwide Customer Service/Support - 24/7
Phone: 1-800-367-4887

To obtain a copy of this instruction manual online, visit our website at *www.brooks.com*
(Adobe® Reader® version 5.0 or higher required)

Instruction Manual

Instruction manual part number 347033
Revision 14 - June 2008